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eTransactions in the Australian Supply Chain Setting

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Abstract

Many sectors of the Australian economy have, in recent years, undertaken an analysis of their supply chain structures. Each sector has determined the underlying technologies to be recommended for use on the basis of past practice in that sector and, in some cases, international practice in the sector. In this article, the authors examine the current role of e-transactions within the context of Australian supply chains.

Our analysis indicates that there is a bifurcation of technical choices along the demarcations of XML and EDI business solutions. For instance, while Mining and Finance have gone the XML route, Wholesale and Retail Trade, along with Transport and Storage have chosen EDI. Moreover, the Health sector appears to be leaning towards keeping both options open to its organizations.

We argue that two factors will need to be considered which will be affected greatly by this parting of the ways on the technology issue. One is the concept of 'design for supply chain' which involves demand generation through joint development of new products and the flow of material across different supply chain entities. The second is the impact of the growth of global trade within international economic blocs.

A natural conclusion is that Australian industry must support a merging of EDI and XML standards.

1. Supply Chains – The Background

Many sectors of the Australian economy have, in recent years, taken on an analysis of their supply chain structures. Although this analysis has taken various forms, a common approach has been for several large organizations, stake-holders in the sector, to band together to fund and support study and development.

Reasons for initiating such projects vary. Faced with cut-backs and down-sizing, some companies have focused on core competencies and attempt to achieve competitive advantage by leveraging their suppliers' capabilities and technologies. Exploitation of these capabilities is expected to result in 'improvements in product quality, quicker integration of technological

breakthroughs, and shorter new product development lead times' [16], thus also providing a competitive edge over competitors.

There is also an expectation of lower transaction costs to the organizations involved as a result of improved trading processes [12]. This is particularly true where businesses at the lower end of the supply chain are not currently trading electronically, but might be encouraged to do so in order to achieve lower costs. However, there are many challenges to integrating businesses' electronic systems through a supply chain, and advice on how to go about it is difficult to come by. A recent study [8] indicates that SMEs greatly underestimate the critical success factors.

Kannan and Tan [9] state that '...no evidence exists on the impact of supplier management on a buying firm's business performance.' In their study, they 'examine relationships between the perceived importance of supplier selection and assessment criteria for items being used in production, and business performance.' Included in the study are several 'hard' criteria such as price and quality, as well as a number of 'soft' criteria such as management compatibility, integrity and buyer-supplier fit. The one supplier assessment factor to correlate positively with all performance measures was also considered to be least important by the group of respondents – all large U.S. firms. This factor was *information sharing*. The authors conclude that 'the results suggest the need for further study of buyer-supplier communication processes. They also suggest a need to develop metrics that allow the effectiveness of buyer-supplier relationships to be assessed.'

In this paper, we consider and compare the approaches to the information sharing mechanisms, integral to the conduct of business within the supply chain, which have been recommended in a number of Australian economic sector projects. The recommendations appear to be essentially one of two choices, resulting in an apparent divergence in solutions adopted by inter-industry sectors.

For this analysis, we have chosen only those sectors in which supply chain management has been undertaken in an attempt to involve the entire sector. Thus, nine out of the seventeen designations of the Australian Bureau of Statistics ANZSIC listing are included here:

- B. Mining
- C. Manufacturing
- E. Construction
- F. Wholesale Trade
- G. Retail Trade
- I. Transport and Storage
- J. Communication Services
- K. Finance and Insurance
- O. Health and Community Services

We discuss the various supply chain management projects undertaken within the last five years or so, particularly in Australia, and provide a description of the information sharing mechanisms chosen. We then consider the implications of these decisions in terms of cross-sector compatibility.

2. The Projects

In this section, we consider supply chain management projects in recent years for nine of the Australian economic sectors and, in particular, focus on eTransaction recommendations arising from those projects.

2.1 Mining

Quadrem was conceived in mid-2000 by 14 of the world's largest mining, minerals and metals companies. Quadrem is a global, internet-based electronic marketplace designed to revolutionize the procurement process in the industry. The marketplace functions are expected to permit participating buyers and suppliers to capture cost reductions and new efficiencies throughout the procurement process. All mining, metals, minerals and mineral processing companies and all suppliers are encouraged to participate. The goals of Quadrem (<http://www.quadrem.com>) as stated on their website are:

- Generate sustainable value for all participants through streamlined transaction and business processes,
- Drive the application of standards in documentation and business processes, and
- Provide many-to-many connectivity for mining buyers and suppliers.

The main areas of focus for Quadrem are on eCatalogues and document exchange.

Quadrem recently signed an agreement with Elemica, the technology infrastructure provider to the chemical industry to create a hub-to-hub connection. Accomplishments and aims of Elemica (<http://www.elemica.com>) are:

- Develop a set of industry-specific transactions.
- Format their transactions using XML.

Quadrem offers a package based on two XML-based standards which, they state, 'provides the infrastructure

that supports the automation of transactions between buyers and sellers and assists with the full integration of these processes into their own systems'. We can say, then, that Quadrem have 2 goals:

- Standardize on XML
- Offer interoperability

These items, taken together, indicate that Quadrem understand the value of adhering to standards, and yet they realize they cannot unilaterally impose a software technology on their customers. Since they are constrained by the investment their potential customers have in packages such as SAP, they aim to provide an interface to such packages.

2.2 Manufacturing

Here, we discuss only two areas, automotive and semiconductor, both of which fall under the 'Manufacturing' heading.

While automotive suppliers vary in their adoption of e-business procedures as a supply chain tool, a recent survey by The Center for Automotive Research [4] indicates that 47% expect it to be a requirement for doing business with the automotive industry within two to three years. Additionally, the survey showed that a majority (81%) of suppliers anticipate a consolidation of the automotive supply chain in the near future, and that, in consequence, customers will reduce their supply chain base all the way along the chain.

The authors of the White Paper on Manufacturing Event Management [2] point out that for automotive suppliers 'the ability to sustain competitive advantage lies in the agility to profitably respond to customers requests'. The White Paper also notes that a move in the industry to 'built-to-order' puts even greater pressure on suppliers to have short lead times, resulting often in high inventory costs.

Tight supply chain structures over many years in the automotive industry have been more conducive to supply chain management strategies than in other sectors, and as a result, a number of off-the-shelf management systems are available. Some of these are PowerB2O, Lean Manufacturing and Supply Chain Execution.

We now turn to the semiconductor section of manufacturing. In many ways, this is similar to the automotive industry because of global coverage and competition alongside a narrow supply chain structure. In 2001, although semiconductor industry capital expenditures fell by more than 35%, companies increased their supply chain management tools budget by 12% [19]. Reasons for the push in this direction include over-inventory and mismanaged inventory situations as well as corporate consolidation. Comparable to 'built-to-order' requirements in the automotive industry are requirements for the handling of 'exceptional' situations for

semiconductor design. Thus software designed for this kind of problem, such as PowerB2O, is popular.

The Semiconductor Research Corporation, which was established in 1982 by the Semiconductor Industry Association, is an international consortium of companies and universities, and as one of its four goals, cites: 'networking among peers up and down the supply chain'. This organization, therefore, ensures that supply chain management issues in the semiconductor industry are acknowledged and addressed.

2.3 Construction

A report of the Australian Construction Industry Forum [15] indicated that 30% of a construction project's total cost is the result of poor information management. Much of the problem is blamed on the failure of hardware and software solutions to meet operational requirements that include mobility of the workforce, diverse working conditions and lack of a fixed infrastructure.

In January 2000, the Construction Industry Advisory Group BSITE (<http://www.bsite.com.au>) was formed. This was an amalgamation of twenty industry leaders from throughout the industry supply chain in both Australia and New Zealand.

BSITE uses technology already prevalent on construction sites, such as mobile phones and fax machines, to perform core functions including job scheduling, time sheeting, activity logging and reporting, contract management, project workflow and document revision.

Thus, rather than being specifically a supply chain management consortium, BSITE focuses on workforce management and project collaboration. They have adopted various global standards for communication between the user and BSITE's software, and have simultaneously used this arrangement to shield the customer completely from the implementation of that software.

Aconex is another Australian business with international customers which targets the same market as BSITE. Their web site (<http://www.aconex.com.au>) says Aconex 'delivers project collaboration software to the global construction and property management industry'. Aconex offer applications which are 'secure, based on 128-bit SSL encryption, and are accessed through standard Internet browsers from anywhere in the world.'

Aconex, then, have taken a different view of the concept of standardization than have BSITE. Rather than target mobile phones, Aconex target customers using standard PCs and provide a single mechanism to access their software.

2.4 Wholesale Trade

The wholesale and retail trade industries must deal with thousands of items, which are bought and sold in numerous locations. The most pressing issue for these industries has been to systematically number products, services, assets and locations, which is precisely what a barcode system is designed to achieve.

The most prevalent bar coding system in Australia is the international EAN system.

EAN has recently joined forces with the Uniform Code Council (UCC) which takes a global leadership role in establishing and promoting multi-industry standards for product identification and related electronic communication with the goal of enhancing supply chain management. The UCC was established in the early 1970's and currently has over 200,000 members worldwide spanning a number of industry sectors including Agriculture, Manufacturing, Utilities, Wholesale and Retail Trade, Communication Services, Property Services, Government, Health and Recreation.

The meat and wool industries form significant components of the wholesale trade industry. Both of these sectors have implemented EAN bar code technology and have developed guidelines for the use of bar codes. For the wool industry, this was completed in 1999 with a committee including both Australian and European wool wholesalers along with CSIRO and EAN [5]. The meat industry's final guidelines were developed jointly between the Australian Meat Industry and EAN and were released in January 2002 [6].

Despite the huge and disparate nature of the wholesale and retail trade industries, much standardization has been achieved by adopting the EAN•UCC numbering and bar coding system (<http://www.ean.com.au>). EAN sees XML as an alternative to UN/EDIFACT in that either one could be adopted as the EDI syntax of choice. Indeed, they understand that it may be necessary for an organization wishing to adopt such a standard to use both in order to achieve interoperability.

2.5 Retail Trade

The grocery segment of the retail industry has implemented an electronic tracking system which is more progressive than those used elsewhere.

The Food Marketing Institute is a U.S. based, but international, professionally staffed organization with close to 2,500 member companies around the world. Although not designed to be a marketplace for the industry, the Food Marketing Institute supports networking between its members and provides relevant, up-to-date information for those working in the sector.

The introduction of ECR (<http://www.ecraustralasia.org.au/index.htm>) in Australia and New Zealand through Efficient Consumer Response Australasia reflects a commitment to take costs out of the grocery supply chain and better satisfy consumer demands through the adoption of world's best practices. Launched in November 1999, ECR Australasia is an informally constituted joint industry body that is supported by the Boards of the Australian Food and Grocery Council (AFGC), Australian Retailers Association, National Association of Retail Grocers of Australia, New Zealand Grocery Marketers' Association, New Zealand Retail Merchants Association and Foodstuffs (NZ) Ltd. The secretariat is located within the AFGC and not as a separate legal entity as in many European countries. Member companies of all supporting organisations are eligible to participate in, provide input to, and access the outputs of ECR Australasia.

ECR Australasia was created with the objectives of:

- delivering benefits to grocery industry trading partners by working together to better meet consumer needs and add consumer value through the establishment of standard industry practices and the development of successful business approaches;
- educating industry participants about the benefits of ECR, through pilots, case studies, seminars and reports; and
- liaising with other industries and organisations, both in Australia and overseas, to ensure common solutions to common problems.

The Uniform Code Council (UCC) is planning some technical innovations specifically for the Retail industry. These include an extension to barcodes called Reduced Space Symbolologies (RSS), expressly for perishables such as produce and meat.

UCC is also promoting Radio Frequency Identification (RFID) tags as a new technology for product labelling. However, RFID is also being promoted as leading to another, albeit unusual, type of interoperability – the fusion of 'physical product flows with the corresponding information flows' (http://www.fmi.org/technology/FMI_it_rfid.pdf). What is new here is the application of RF tag technology to retail products.

Another organization advocating standards for the retail industry is Voluntary Interindustry Commerce Standards (VICS) (<http://www.vics.org>). Their focus is the VICS Standard Bill of Lading (BOL) and 2003 is the target year for the mandatory adoption of the 17-digit VICS BOL number. An interesting point is that they say bar code printing of this BOL number is optional but, if printed, must be done using EAN•UCC-128 symbology.

We note that EAN•UCC appears under various industry sectors in this paper, and so is clearly a standard which can claim to be 'cross-sector'. This can also be

interpreted as meaning that retail trade is not trying to develop standards in isolation to other components of a complex, technology-based society.

2.6 Transport and Storage

In a presentation to the Working Party for the Information Economy Group of the OECD, Malone [11] states that 'The transport industry provides the logistical operations for Australian business through the movement of goods in the supply chain and to market. These key horizontal linkages mean that transport makes a significant contribution to the Gross Domestic Product...Transport activities underpin the effectiveness of hundreds of thousands of small businesses in Australia —

- it is a sector that cannot be disintermediated in the supply chain for goods;
- it accounts for a high proportion of transaction costs; and
- its adoption of e-commerce is likely to drive e-commerce uptake in the many sectors it services...with consequent benefits for those services.'

The Australian government has therefore undertaken, in partnership with industry, to facilitate and support e-commerce uptake specifically in the transport and logistics sector. The government-sponsored 'Trucks Online' project was completed in 1998 and proposed an EDI solution.

Tradegate-ECA is a not-for-profit, non-government, Australian user organisation, headquartered in Sydney, Australia. Its role is to facilitate the use of electronic commerce techniques for the exchange of information between customers and their suppliers, with a focus on exporting and importing. It does this by bringing together many different types of organisations involved in several supply chains so that a common agreed strategy can be developed and implemented using the relevant international standards. Thus, in many ways, it is a cross sector approach to trading.

The Tradegate 'community' has 850 members across Australia, including air and shipping lines, freight forwarders, railway operators, customs brokers, trucking companies, importers and exporters, banks and insurance companies.

Tradegate's Domestic Transport Project, DOMEDI, has implemented the following:

- Adopt the global EAN•UCC numbering and bar coding system
- Standardize message types rather than (product-specific) messages
- Standardize at federal government level
- Encourage industry-wide adoption, i.e. interoperability between companies

- Incorporate overseas work, i.e. encourage interoperability between countries.

These days, transport is more often referred to as Logistics Chain Management since it is viewed as being an integral part of Supply Chain Management.

An Australian company specializing in software for this field is Logistics Systems International (<http://www.lsi.net.au>) which targets interoperability between the sending, transport and receiving systems using standard barcode technology for tracking purposes.

2.7 Communication Services

Despite the fact that the telecommunications industry is the provider of the means of electronic invoicing to all other industries, it itself is so highly competitive that it has not reached the point at which a group of major players in the industry has seen the imperative to form a consortium.

A large number of organizations (Deloitte Touche and Tohmatsu, Canopy International) provide professional services such as supply chain assessment, strategic and financial consulting specifically targeting the telecommunications industry.

In Australia, SETEL – Small Enterprise Telecommunications Centre Limited – has sought to replicate the Business Council of Australia e-Commerce Roundtable in pulling SMEs in the industry into a forum to ensure that:

- Carriers and providers give out accurate and timely information about products and services, and that
- Small businesses take steps to inform themselves about products and services as part of responsible business decision making.

SETEL was established in 1992 to service the research, policy and information needs of the small business members of the Telstra Small Enterprise Policy Panel, plus the wider small business community, and to provide research material from the Small Business sector perspective. SETEL [17] has an important document available for people who want a gentle introduction to reasons for the adoption of eCommerce, and which discusses the influence this adoption will have on a business's supply chain.

2.8 Finance and Insurance

In the banking industry, the SWIFT consortium has been around since 1977. SWIFT (<http://www.swift.com>) is an industry-owned, international cooperative (under Belgian law) supplying secure messaging services and interface software to 7,000 financial institutions in 200 countries, and it employs about 1,500 people. SWIFT provides messaging services to banks, broker/dealers and investment managers, as well as to market infrastructures

in payments, treasury, securities and trade. These services are designed to help customers reduce costs, improve automation and manage risk. The guiding principles of SWIFT are: to offer the financial services industry a common platform of advanced technology and access to shared solutions through which each member can build its competitive edge. The solutions developed are based on XML.

In order to join SWIFT a minimum level of infrastructure must be in place, and so small business is to a large extent excluded from membership. In early 2002, SWIFT migrated from X.25 connectivity to IP connectivity and has established SWIFTNet and SWIFTNet FIN to assist with the move.

Considering that 'SWIFT is the industry-owned cooperative supplying secure messaging services and interface software to 7,000 financial institutions in 198 countries', this indicates that:

- the financial sector is capable of being intensely focused
- intercontinental interoperability can be achieved
- in this, admittedly unique, sector, convergence on a single standard is possible.

SWIFT standards are based on, but not limited to, ISO 15022, XML and XML schemas.

In the Australian health insurance area, SuperEC (<http://www.superec.org>) got off the ground in 2000. It has three levels of membership with over two dozen members. The governing council is comprised of four key bodies: the Association of Superannuation Funds of Australia Limited, the Australian Taxation Office, the Investment and Financial Services Association, and the Association of Payroll Specialists. An early policy decision for SuperEC was to ensure that the standards would be written in a manner that is neutral to the technical transport mechanism. Another decision was to choose technologies that would allow participation at a low cost. Technically, the standards are a set of XML message packets that may be sent as attached, encrypted email. This set of technologies is available on all platforms and at a relatively low cost of implementation. SuperEC has also developed messaging standards for the industry. SuperEC itself is based on ebXML [3].

A recent move in this sector has been to a business reporting standard with the introduction of XBRL (See <http://docs.hr-xml.org/20010419/XBRL-ExecSummaryGeneral%20Ledger.pdf> for a summary provided by XBRL.org). This is an open specification standard for software, developed by almost 200 companies, professional organizations and governments world-wide, which is designed to capture, analyze and reuse business information. It is based on XML and is compatible with ebXML.

2.9 Health

An innovative e-commerce project begun in the late nineties in Australia was PeCC, originally 'Pharmaceutical Electronic Commerce and Communication', but later changed to 'Project for Electronic Commerce and Communication'. Quoting from [18], 'PeCC's vision was to link the pharmaceutical supply chain end-to-end, starting with manufacturers and ending with the consumption point – the hospital patient...The vision included a common numbering system and integrated information systems throughout health so that products could be ordered, coded, tracked, delivered, stored, dispensed with barcode-swiping all the way. EDI was successfully implemented for orders and confirmations for manufacturers and distributors, with supply chain reform pilots in some hospitals.' But because of confusion over EDI protocol standards, 'there is a general movement towards a common standard called X12. This, in turn, is part of an international movement towards UN/EDIFACT' [13].

Since UN/EDIFACT is becoming so widespread, it is clear that this drive for interoperability within the health sector should automatically lead to interoperability with players in other industry sectors.

The National Supply Chain Reform Task Force (NSCRTF) was established in 2000 to identify key areas for joint work between governments, the hospital sector and product suppliers to facilitate the adoption of an e-enabled supply chain in hospitals. Their report, (NSCRTF 2003) indicated that there were many weaknesses in the sector. In January 2002, the Australian Health Ministers' Advisory Committee endorsed the NSCRTF national plan covering five key areas. The list of tools identified as needing consideration for use in the industry are: EDI, XML, EAN barcoding, e-marketplaces and e-catalogues, web services, e-mail and fax.

It is unfortunate that, in 1983, the health industry in North America established a barcoding system through its Health Industry Business Communications Council (HIBCC; <http://www.hibcc.org/barcode.htm>) which is formatted differently from the EAN codes. The global health industry tends to have adopted the North American style coding.

A number of related health industry projects have sprung up in Australia over the last few years. One such is the ICTeHealth Project, which includes the PeCC and NSCRTF perspectives, and focuses on determining the data interoperability problems in New South Wales hospitals. This project began in 2002 and is concerned with investigating the flow of information in four key areas of clinical process within a hospital setting – pathology, pharmacy, purchasing and radiology.

At the international level, two projects stand out:

Global Health Exchange (<http://www.ghx.com>) was founded in 2000 by five leading health care suppliers: J&J, GE Medical, Baxter, Abbot Labs and Medtronic. It provides supply chain solutions to bring together hospitals, manufacturers and wholesalers. They have developed a range of product components which connect in various ways to GHX's own AllSource system. For instance, hospital staff can use a web browser to connect to AllSource, or GHX and their partners can provide customized code which links a hospital's existing ERP system to AllSource. AllSource corresponds exactly to HIBCC's Universal Product Number Repository, which means a single converter between the two would serve all users of both systems.

HL7 promotes a set of American National Standards Institute (ANSI)-approved standards, covering clinical documents and the sharing of medical knowledge, as well as administrative documents covering intellectual property, ethics, and so on. The clinical-type documents are XML-based, so as to be both human- and machine-readable, and to be deliverable to devices such as web browsers and mobile phones.

Their Reference Information Model (RIM) is actually expressed in the Unified Modeling Language (UML). RIM is not a product-based approach, but a clinical-activity-based approach, and hence differs significantly from previously mentioned systems.

3. The Cross-Sector Issues

We have seen above that Australian industry sectors have generally taken one of two paths when instituting technical solutions to their cross sector business: a choice between XML and EDI.

The question remains: for those companies who must work cross-sector, and for those who do business on the global scene, how large is the barrier imposed by the use of two separate and very different schemas?

Handfield and Nichols [7] point out that 'Supply chain members will increasingly need to improve coordination not only in the area of demand replenishment, but also in the area of demand generation through joint development of new products. ...An equally important benefit of this collaboration is the increased standardization and simplification of product designs that can lead to a "design for supply chain" approach.... Design for supply chain extends the concept of "design for manufacturability", which refers to the process of simplifying product designs to allow easier manufacture and assembly, to the broader scope of the entire flow of material across different supply chain entities.'

Thus, these authors imply that in order for supply chain management effectiveness to move to 'the next level', the technical ability to work seamlessly across sectors must be in place.

On another level, they note that global trade “is increasingly taking place within blocs, such as the European union, the North American Free Trade Area, and other regional groups. ...the bulk of international trade takes place in materials and intermediate components. Global corporations will ship semi-manufactured products between their own facilities or from suppliers to assembly plants and distribution centers. The trend toward global supply chains has been fueled by needs for centralized research and development, the development of homogeneous markets and global products and global market segments for many products, the need for economies of scale in specific industries, wage differentials between advanced countries and other less developed countries, and political efforts to maintain low tariff barriers.”

They raise a number of important questions about global supply chains and their management, arguing that the crossing of international boundaries must necessarily impact business strategies. One of the specific questions not posed is the issue of technology, and whether it will be *possible* to integrate different business technologies across global supply chains.

It is clear to the present authors that the technology may well be one of the most significant barriers to the development of any economy past national boundaries. The problem of interoperability has already been recognized by several major players. Microsoft, as part of a ‘module map’ for reshaping business software [1], has plans to develop software for small to medium-sized businesses which is ‘fully interoperable and interconnectable’. One of the biggest problems faced by companies who have invested large amounts in expensive software is to get it all to work together. While this sounds as if Microsoft has solved the XML versus EDI problem, this is not the case. Microsoft is using XML to enable web services via their .NET system. Sun and IBM have taken up similar strategies, Sun One and WebSphere, both based on XML.

The UCC was, from its inception, a proponent of EDI and in 1996, at the urging of a number of commercial and industrial sectors, conducted a study to determine the feasibility of merging several different existing implementation guidelines into one. The positive feedback from this feasibility study resulted in the development of an Industrial/Commercial purchase order based on the United States EDI ASC X12 national standard, and in November 1997, the UCC became the management and administrative body for I/C EDI.

The priorities of early EDI standardization were in the areas of customs, commerce and transport. Europe and the United States developed EDI solutions independently. The European version, EDIFACT, included accounting functionality while ASC X12 did not. In contrast, the aims of XML were to be non-proprietary and self-

describing, and flexibility rather than standardization was a main goal.

With the strong push in the business world to the use of XML, the link between EDI and UCC is founded on a set of Business Messaging Standards based on XML, and this is consistent with the move to interoperability of EDI and XML via xCBL and XRBL. The EDI standards committee X12 along with UN/EDIFACT are now working on Next Generation EDI based on XML, which appears to focus only on internal financial and managerial reporting.

4. Conclusions and Recommendations

In choosing technical standards to support supply chain management, a number of Australian industry sectors have chosen to go with XML based standards while others have gone with EDI. While recent developments have seen a significant improvement in interoperability between these two standards, the cost of the interface remains high.

In order for Australian commerce to remain competitive in a global environment, where increased standardization and simplification of product design are expected, the technical ability to work seamlessly across sectors and national boundaries is an imperative.

In addition, the move to trading within and between geographic and political ‘blocs’, resulting in global supply chains, must inevitably lead to an integration of business technologies across large sectors.

To enable Australian business to stay abreast of these global moves, the authors therefore propose the development of a universally and freely available translation scheme between the most recent XML and EDI syntax versions organized by the Uniform Code Council in conjunction with those sectors which would benefit immediately: Wholesale and Retail Trade, Transport and Storage, and Health. Such a translation scheme would be an inexpensive solution to the interoperability problem and, based on experience of the authors [10] could be achieved within two to three years.

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